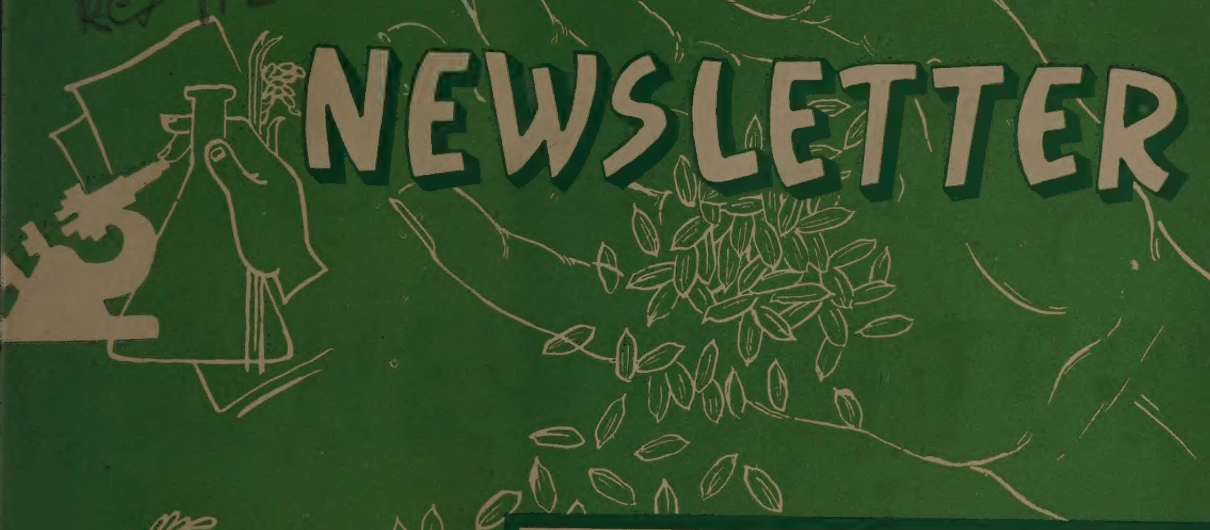
INTERNATIONAL RICE COMMISSION

NEWSLETTER



Vol. VII, No. 3 September, 1958

12/E

CONTENTS

FOOD AND AGRICULTURE ORGANIZATION
REGIONAL OFFICE FOR ASIA AND THE FAR EAST
BANGKOK THAILAND

THE INTERNATIONAL RICE COMMISSION

The International Rice Commission was established under the sponsorship of the FAO for the purpose of promoting national and international activity in respect of production, conservation, distribution and consumption of rice, except matters relating to international trade. At present it has 26 member governments, namely :

Australia	India	Pakistan
Burma	Indonesia	Paraguay
Cambodia	Iran	Philippines
Ceylon	Italy	Portugal
Cuba	Japan	Thailand
Dominican Republic	Korea	United Kingdom
Ecuador	Laos	United States of America
Egypt	Mexico	Vietnam.
France	Netherlands	

The First Session of the Commission was held in Bangkok, Thailand, March 1949; the Second Session in Rangoon, Burma, February 1950; the Third Session in Bandung, Indonesia, May 1952; the Fourth Session in Tokyo, Japan, October 1954; and the Fifth Session in Calcutta, India, November 1956.

For technical matters the Commission has special working groups. At first the Commission began with two working parties – one on rice breeding and the other on fertilizers – organized in 1950 and 1951 respectively. In 1954 the Commission added three more working groups to work on the topics of rice storage and processing; mechanization of rice production; and soil-water-plant relationships in the production of rice.

Done from F.A.O. Pl. Prot. Bull. 6, 11, pp-161-166, 1958

THE HOJA BLANCA DISEASE OF RICE

John G. Atkins

and

Judson U. McGuire, Jr.[1]

Hoja blanca or white leaf, a destructive insect-transmitted virus disease, has been recognized as a potentially serious disease of the United States rice crop. In 1956 rice specialists of the U.S. Department of Agriculture and the State experiment stations became interested in hoja blanca in view of the heavy yield losses in Cuba and Venezuela. In 1957 studies were initiated in Cuba and Venezuela.

Distribution. In 1956 hoja blanca was recognized as one of the more destructive rice diseases of Cuba. However, Mr. Henry M. Beachell, Agronomist, Crops Research Division, Agricultural Research Service, United States Department of Agriculture, and Dr. Julian Acuna, Plant Pathologist, Ministry of Agriculture, Havana, Cuba, observed the disease in Cuba in 1954. While the disease was evidently of little importance in 1954, hoja blanca increased rapidly in 1955 and caused serious losses on some farms. Cralley (5) observed the disease in Panama as early as 1952, where it was apparently of minor importance. Malaguti (10) reported that hoja blanca appeared in 1956 in Venezuela and caused severe yield losses, particularly in Protuguese state. In letters to the United States Department of Agriculture, Dr. Eddie Echandi, Plant Pathologist, University of Costa Rica, and Mrs. Lucy H. de Guttierrez, Plant Pathologist, Inter-American Institute of Agricultural Sciences, Turrialba, reported that hoja blanca was found in 1957 in Costa Rica. In January 1958, hoja blanca was identified in Colombia by Dr. C. Roy Adair, Agronomist, Crops Research Division, Agricultural Research Service, United States Department of Agriculture, and Dr. Peter R. Jennings, Geneticist, Rockefeller Foundation, together with representatives of the Ministry of Agriculture of Colombia.

Hoja blanca was identified in early September of 1957 on rice near Belle Glade, Florida, although suspected plants had been observed in August (1, 4, 6). The diseased rice was destroyed and the areas sprayed with an insecticide. The writers wish to point out that the Florida rice acreage around Belle Glade is several hundred miles distant from the important southern rice areas, but do not wish to minimize the importance of the occurrence of hoja blanca in Florida.

1. *Pathologist, Crops Research Division, and Entomologist, Entomology Research Division, Agricultural Research Service, United States Department of Agriculture, respectively.*

Losses. Hoja blanca causes slight to nearly complete yield losses, depending upon the extent of infection. Losses of 40 to 75 per cent for individual fields have been common. While reliable estimates or records for geographical units (states, provinces, etc.) are not available for Cuba and Venezuela, losses in certain of the leading rice areas have been disastrous. Losses on individual rice farms have been such as to render the growing of susceptible varieties unprofitable.

Symptoms. Hoja blanca symptoms consist of one or more narrow, longitudinal white stripes of the leaf blade, nearly white leaf blades, or leaves mottled in a mosaic pattern. Diseased plants show considerable variation as to type of foliar symptoms. Both normal and diseased tillers frequently are observed on the same plant. Affected tillers are reduced in height. The panicles of diseased tillers are somewhat reduced in size, often are not fully exserted from the sheath, and they break easily at the lower end of the top internode when pulled upward. The lemma and palea frequently are distorted in shape, dry out rapidly and show a brownish discoloration. The floral parts are often absent, or if present they are sterile. As a result, panicles of diseased plants contain few or no seeds and remain in an upright position.

While there seems to be some disagreement among specialists as to when symptoms first appear under field conditions, plants should be at least in the four-leaf stage or approximately 30 days old for diagnostic purposes. Malaguti, Diaz and Angeles (11) observed symptoms 23 days after the initial feeding of viruliferous insects. Acuna (2) obtained symptoms afer 16 days.

Infected plants, unless infected at a very early stage, are not killed by the disease, and new tillers of a second or ratoon crop often show no symptoms. Entries rated as resistant in the first crop were also resistant in the second crop in one of the 1957 nurseries.

Host Range. While the host range of hoja blanca has not yet been established by inoculation studies, the disease is suspected of having a fairly wide host range among the grasses (gramineae). Several different grasses growing in or adjacent to the fields of diseased rice often show symptoms similar to those for hoja blanca on rice (3, 4, 5, 7, 10, 12). While *Echinochloa* species exhibit quite distinct symptoms, other grasses show only obscure symptoms which may or may not be due to the hoja blanca virus or to any virus.

Red rice is also susceptible to hoja blanca. While red rice belongs to the same species as our cultivated varieties, it is considered as a weed pest in commercial rice fields.

Factors Influencing Disease Development. Surveys and reports indicate that the severity of hoja blanca varies with the field, the area, the country, the year and the season or month. Future studies will undoubtedly provide information as to the factors responsible for differnces in the severity of disease development. The disease occurs in both upland and irrigated rice, but perhaps not with equal severity. Applications of fertilizers and minor elements have had no pronounced effect. The disease has occurred on different soil types and in fields of different cropping sequence. Insect populations are known to vary both as to species and numbers of specific species. Studies in progress on the insect populations should provide information that may explain some of the variations in disease development.

In Cuba susceptible rice varieties seeded in December, January or early February have shown less damage than when sown in March, April or May. Date-of-seeding tests are in progress. While the date of seeding appears to be an important factor in Cuba, seasonal variations are relatively unimportant in Venezuela.

Insect Vectors. Hoja blanca has been recognized as having symptoms similar to those for the stripe disease of Japan (8, 9, 13). This disease is transmitted by a delphacid *Delphacodes striatella* Fall. (13) of the Fulgoroidea. While *D. striatella* has not been found in rice fields showing hoja blanca, several genera of delphacid leafhoppers occur together with many genera of cicadellid leafhoppers.[2] Malaguti, Diaz and Angeles (11) report transmission with leafhoppers. They were unable to obtain transmission by manual methods or by seeds from diseased plants. Acuna (2) reported *Sogata orizicola* Muir to be an important vector in Cuba and indicates that *H. similis* is not. *S. orizicola* has been identified in insect collections from fields of diseased rice in Cuba, Venezuela, Colombia and Belle Glade, Florida.[2] Other genera of leafhoppers are being tested as vectors.

Varietal Resistance. In 1957 the reaction of a large number of United States rice varieties, selections and introductions from the United States Department of Agriculture World Rice Collection was determined in tests conducted in Cuba and Venezuela (4). Hoja Blanca Nursery No. 1, consisting of 2,200 entries, was sown on two dates near Acariqua, Venezuela.[3] Ratings were made on the two plantings approximately 100 and 95 days, respectively, after seeding. The nursery of 2,200 entries and an additional nursery of 1,725 entries were grown in a test area near Jobabo, Cuba,[4] where observations

2. *Reports on insect collections submitted to the Insect Identification Section, Entomology Research Division, Agricultural Research Service, United States Department of Agriculture.*
3. *In cooperation with Mr. Rufus K. Walker, Research Director, Narfarm, Valencia, Venezuela.*
4. *In cooperation with Mr. William C. Davis, Vice-President, Arrozal Bartes, S.A.*

were made at approximately 40 and 95 days after seeding. Throughout the nurseries certain United States varieties were included every 20 rows as "check" varieties. A scale of O to 9 was used for rating severity. Natural infection was heavy on susceptible entries at both locations.

A fairly large number of the entries were rated as resistant to hoja blanca since they showed few or no diseased tillers and growth and grain development were normal. Table 1 gives the country of origin of the various entries and the resistant entries. As shown in Table 1, a large number of the resistant entries came from Japan, China, Taiwan or Korea. Most of the resistant entries were *japonica* types, which may be characterized as short-grain rices with rough, fairly narrow, dark green leaves. Similar types were observed among resistant entries from other countries of the world. Probably, if the origin of all the resistant entries included in the tabulation were known, the total number of resistant entries from Japan and China would be larger, or else there would be many duplications.

All of the leading United States varieties and all domestic long-grain varieties were susceptible. Several minor United States short- and medium-grain varieties, such as Colusa, Asahi, Lacrosse and Missouri R-500, were resistant and Arkrose was moderately resistant (Table 2). In addition, a number of short- and medium-grain selections were resistant. Certain of the resistant selections are adapted types and, if necessary, they could be grown in the United States.

One of the objectives of the 1957 tests was to screen the United States Department of Agriculture rice collection for sources of hoja blanca resistance. As shown in Table 1, a fairly large number of entries which might be used in breeding to develop hoja blanca resistant varieties are available. However, most of these are short-grain or medium-grain rices. The very few long-grain entries that were rated as resistant are of undesirable plant types.

A check as to the origin or parentage of the resistant United States varieties and selections indicates that *japonica* or short-grain types are the sources of their resistance. Asahi is an introduced variety from Japan, while Colusa was selected from an introduction from Italy that originally came from China. Possibly the resistance of Lacrosse, Missouri R-500 and several selections came from short-grain parents. A number of resistant selections had Lacrosse as one of the parents. Some of the selections from each of two crosses between Lacrosse and a susceptible parent were resistant like Lacrosse, whereas others were completely susceptible. These results indicate that it should be possible to obtain resistant strains of all grain types.

Table 1. *Tabulation of resistant entries in Hoja Blanca Nursery No. 1 by country of origin, grown in Cuba and Venezuela, 1957*

Country of origin	No. entries tested	No. classed as: Resistant	Moderately resistant
United States	831	48	29
China	528	135	77
Japan	290	182	45
Korea	105	50	32
Taiwan	49	45	1
Burma	5	0	0
India	29	2	2
Indonesia	10	0	0
Philippines	5	0	0
Thailand	4	1	0
Argentina	11	6	0
Brazil	12	3	0
Br. Guiana	3	0	0
Chile	2	2	0
Peru	16	1	2
Venezuela	16	2	0
Costa Rica	4	2	2
El Salvador	15	2	2
Haiti	15	1	0
Jamaica	2	1	1
Austria	2	0	1
France	11	6	1
Greece	2	0	1
Italy	31	15	4
Portugal	17	13	1
Spain	10	9	0
Yugoslavia	3	1	0
Iran	7	1	0
Turkey	26	7	6
Africa, except Egypt	15	0	0
Egypt	6	3	3
Miscellaneous	8	2	0
Total	2,090	540	210

Table 2. *Hoja blanca ratings for the leading United States rice varieties and a group of resistant selections and minor varieties in Cuba and Venezuela, 1957*

Variety or selection	C.I. no.	F.A.O. genetic stock no.	Hoja blanca ratings[1] Cuba May	Cuba July	Venezuela May	Venezuela August	Probable reaction
Susceptible:							
Fortuna	1344	220	3	8	7	9	S
Caloro	1561-1	221	3	7	7	–	S
Rexoro	1779	214	2	7	8	8	S
Zenith	7787	206	3	8	5	8	S
Magnolia	8318	216	2	7	8	8	S
Texas Patna	8321	221	2	7	6	8	S
Bluebonnet 50	8990	1012	2	7	7	9	S
TP 49	8991	1020	2	7	5	8	S
Century Patna 231	8993	1014	3	5	7	8	S
Nato	8998	–	3	6	6	9	S
Toro	9013	–	3	8	6	9	S
Resistant:							
Colusa	1600	213	0	0	0	–	R
Arkrose	8310	207	2	1	3	tr	MR
Asahi	8312	–	tr	0	0	0	R
Lacrosse	8985	1017	0	0	1	0	R
Lacrosse x Magnolia	9001	–	2	0	0	0	R
Missouri R-500	9155	–	1	0	1	0	R
Bruin Sel. x Zenith	9209	–	0	0	tr	0	R
Lacrosse x 253			0	0	1	0	R
Lacrosse x Zenith-Nira			0	0	0	0	R
Lacrosse x Arkrose			0	tr	0	tr	R
Hyb. Mix. 11-49-19-5	9368		0	0	0	0	R

1. *Visual rating scale, 0-9.*
0 = No disease.
9 = Severe disease.

Literature Cited

1. Anon. 1957. Hoja blanca rice disease found in Florida. United States Department of Agriculture Release 2812-57, dated September 18, 1957. (Also, Rice Journal 60 (11): 10-11. 1957)

2. Acuna G., Julian. 1958. Informe de la labor realizada por la "comision para la investigacion de las enfermedades del arroz" durante el mes noviembre de mil novecientos cincuenta y siete. In: Informaciones de Interes General en Relacion con el Arroz. Administracion de Estabilizacion del Arroz. Boletin No. 4: 26-40.

3. Adair, C. Roy and J.W. Ingram. 1957. Plans for the study of Hoja blanca, a new rice disease. Rice Journal 60 (4): 12.

4. Atkins, John G. and C. Roy Adair. 1957. Recent discovery of hoja blanca, a new rice disease in Florida, and varietal resistance tests in Cuba and Venezuela. Plant Disease Reporter 41 (11): 911-915.

5. Cralley, E.M. 1957. "Hoja blanca" – White Leaf – A New Disease of Rice. Arkansas Farm Research 6 (5): 9.

6. Green, Victor E. Jr., and James D. Panzer. 1958. Hoja blanca. Rice Journal 61 (2): 16, 19, 20, 23, 24, 26.

7. Green, Victor E. Jr., and Joseph R. Orsenigo. 1958. Wild grasses as possible alternate hosts of "hoja blanca" (white leaf) disease of rice. Plant Disease Reporter 42 (3): 342-345.

8. Hashioka, Y. 1951. Rice stripe (Oryza virus 2). Hokuriku National Agr. Exp. Sta. Farmers' Bulletin, 7 pp. (English summary)

9. Kawada, Akira, Shizuo Kato, Hideo Mukoo and Kazuo Fukunaga. 1954. Insects and diseases of rice plants in Japan. National Institute of Agricultural Sciences. 33 pp. 11 plates. Tokyo, Japan.

10. Malaguti, Gino. 1956. La "hoja blanca", extrana enfermedad del arroz en Venezuela. Agronomia Tropical 6 (3): 141-144.

11. Malaguti, G., H. Diaz C., y N. Angeles. 1957. La virosis "hoja blanca" del arroz. Agronomia Tropical 6 (4): 157-163.

12. Mukoo, Hideo and Tositake Iida. 1957. Informe sobre la investigacion de la hoja blanca del arroz en Cuba. In: Divulgacion Cientifica (Raya Blanca). Administracion de Estabilizacion del Arroz, Boletin No. 1: 5-12.

13. Yamada, W. and H. Yamamoto. 1955. Studies on the stripe disease of rice plant. I. On the virus transmission by an insect, *Delphacodes striatella* Fallen. (With English summary) Okayama Pref. Agr. Exp. Sta. Spec. Bul. 52: 93-112.

IF EACH FIELD GROWS ITS MANURE[1]

M.S. Sivaraman, I.C.S.
Adviser, Program Administration
Planning Commission, New Delhi, India

1. INTRODUCTION

The food situation in India has been unsatisfactory for some time. Many measures have been taken to increase food production such as expansion of the irrigated area, extensive use of chemical fertilizers and adoption of improved methods of cultivation. Although these measures have resulted in some production increase, the amount has not been sufficient to offset the increase in population and a change in food habits of certain people. During the past 20 years, the population of the country has increased by over 70 million and the urban population by over 30 million. The demand for wheat and rice has been constantly on the increase and so they have to be imported to make up the shortage.

Since the possibility of expanding the present area under cultivation is very much limited, the solution of our food problem lies in the increase of our acre yield.

2. NITROGEN DEFICIENCY – A CAUSE OF LOW YIELD

Indian soils are generally rich in potash and adequate in phosphate supplies but deficient in lime in some places. Nitrogen, however, is deficient all over the country. It is estimated that the major crops in India remove annually over 3.8 million tons of nitrogen from the land, and that the amount of nitrogen returned to it in the forms of farm manure, composts, green manure, oil cakes and chemical fertilizers is less than a million tons a year.

Since nitrogen is deficient all over the country and it thus becomes a most important limiting factor of crop production, any measure of improvement must involve the problem of increasing nitrogen supplies in the soil.

3. THE USE OF ORGANIC MANURE – A SOLUTION

The common source of nitrogen supply is farm yard manure, which is limited in India as a large portion of cattle dung is used as fuel. Chemical fertilizers will be helpful in irrigated areas, but the quantity available in the

1. *For lack of space, this article has been very much condensed from its original form. Editor's Note.*

country is hardly sufficient for one fourth of the present irrigated areas of about 60 million acres. Moreover, the use of fertilizers is risky in rainfed areas unless the rainfall is well distributed. Oil cake is also an important source of concentrated organic nitrogen, but the cost of using it on cereal crops is almost prohibitive.

Of the various sources of nitrogen supplies green manure and soil composts have distinct possibilities of rapid extension in India. From experiments it has been found that green manure could increase the yield of paddy and wheat from 20 to 40 per cent. At present less than 10 per cent of the area has benefited from it. The chief reason for this seems to be the inadequate supply of green manure seeds. The severe summer and winter conditions is North India are not favorable to the production of green manure seeds. It is only in the rainy season that seeds can be produced in the north, but such cultivation cannot compensate the cultivator for the loss of other crops which he could have grown. In a few places, small quantities of Sannhemp (*Crotalaria juncea*) are raised as a fibre crop or as a mixed crop with millets and pulses. In the south where the climatic conditions are comparatively mild, wild indigo (*Tephrosia purpurea*) and Pilli pesara (*Phaseolus trilobus*) are raised during the summer as green manure crops after the harvest of paddy, but the production of seeds is uncertain due to heavy rainfall.

To meet the climatic conditions in India, a kind of green manure crop should be found that can stand dry conditions in the early stage of its growth as well as excess of water in the later stage. It should be fast growing and capable of yielding four to eight thousand pounds of green manure per acre in four to six weeks before the paddy season begins from July. Moreover, it should be a crop which can thrive on all types of soil, including alkaline conditions, and it should be resistant to pests and diseases.

4. THE PROBLEM OF SEED PRODUCTION

From observations I have found the following plants that may be used either to produce seeds for green manure crops or to produce vegetative growth for making soil composts:

Sesbani speciosa seedlings are found to grow in irrigation channels even after they are full of water because the plants can develop adventitious roots that float in water. Thus *Sesbania speciosa*, unlike Sannhemp, Pilli pesara or wild indigo, can grow in paddy fields. If a small number of these plants raised on the borders of a field can produce seed enough for growing a crop of green manure in that field, then the problem of seed production is solved.

Ipomoea carnea is a quick growing shrub, sometimes raised as a hedge plant. It has no thorns and can withstand severe lopping every two months and thrive under extreme conditions.

Glyricidia is usually cultivated as a shade plant in tea estates. It can withstand severe lopping and, though not adapted to water-logged conditions, it thrives on the bunds of paddy fields.

Indigofera teysmanni is as useful as *Glyricidia*. In 1951, I obtained two dozen seeds from Ceylon and planted them in Madras. Each plant produced about two pounds of seeds after a year and over one hundred thousand *Indigofera teysmanni* plants were grown in one research station in 1953 for demonstration.

Sesbania aegyptiaca is another quick growing perennial shrub that is grown all over India. It can be lopped frequently and produce abundant seeds and leaves. There are places in the Madras State where cultivators produce their entire organic manure requirements by growing *Pongamia glabra* on the borders of fields. The leaves of this tree are used as green manure for paddy fields or composted for use on dry fields. The crop yields of these cultivators are four to five times the average for India and the crops are not affected by the adjacent tree growth.

5. EXPERIENCES IN THE MADRAS STATE

As director of agriculture in the Madras State in the earlier years, I have been able to carry out my observations and ideas about the use of organic matter for increasing crop production throughout the state. Many state agricultural research stations in Madras were then short of manures and this was made good by purchasing town-composts, farm yard manure or oil cakes. As a first step, this practice was immediately stopped. The officers in-charge of these state farms were directed to develop local manurial resources to a level of self-sufficiency by raising green manure crops and by planting quick growing shrubs. I suggested the possiblity of producing green manure seeds by growing *Sesbania speciosa* on the bunds of paddy fields as well as in the fields by transplanting seedlings. The farm superintendents were also required to grow quick growing shrubs like *Glyricidia*, *Sesbania aegyptiaca*, *Indigofera teysmanni*, *Ipomoea carnea*, *Calotropis gigantea* and *Adathosa vasica*. A detailed study was made of the seed production of *Sesbania speciosa*. The quantity of leaves produced by the various shrubs at each lopping, the ability of the plants to stand frequent lopping, the optimum intervals for lopping and the quantity of manure produced in a year were also observed.

It was found that, by growing *Sesbania speciosa* 2 to 3 ft. apart on the

bunds or in the field, it is possible to produce in an acre area sufficient seeds for raising a crop of green manure for use in two to three acres. Dhaincha (*Sesbania aculeata*) was found to be equally adapted to certain places like the coastal areas of the state. The growing of such green manure plants or perennial shrubs did not have any adverse effect on the crops in the field. By raising *Sesbania speciosa* 2 to 3 inches apart in a field along with the first crop of paddy, it was possible to produce sufficient green manure for the second crop. Among the plants studied *Glyricidia, Ipomoea carnea, Indigofera teysmanni* and *Sesbania aegyptiaca* were found to grow under widely different conditions and to produce large quantities of green leaves from frequent loppings.

The result of these experiments was remarkable. All the state agricultural research, experimental and demonstration farms in Madras became self-sufficient in organic manure within three to four years. Every farm became virtually a factory for producing its own manure without in any way affecting its normal cropping pattern. For instance, the production of green manure in the Aduthurai Rice Research Station was increased from 20 tons in 1948-49 to 397 tons in 1952-53 and the total annual production of paddy from the farm rose from 107,000 lbs. in 1948-49 to 233,000 lbs. in 1952-53. The average acre yield for the farm was therefore raised from 1,860 lbs. of paddy to 3,085 lbs. At the Kovilpatti Agricultural Research Station, the production of composts from loppings of perennial shrubs like *Ipomoea carnea* and *Glyricidia* was 346 tons in the third year of their planting.

In the Madras State it can now be confidently concluded that on every farm holding, irrespective of its size, it is possible to produce its requirements for organic matter either by making composts for use on dry land or by growing green manure crops for use in paddy fields, without in any way affecting the usual cropping system. It may be added that, during the first five year plan period, the highest increase in rice yield has been in the Madras State. The increase was more than 50 per cent.

6. APPLICATION OF THE EXPERIENCES IN ALL INDIA

The climatic and soil conditions of the research farms in Madras are just as diverse as they are in whole India and so the results obtained in Madras can be applied equally well to the rest of the country. Plants like *Ipomoea carnea* and *Sebania aegyptiaca* thrive in all parts of the country, while *Glyricidia* and *Indigofera teysmanni* grow well in most places. The cultivation of these plants should be extended to every field in every village throughout the country in two to three years.

No permanent improvement in agricultural production in India can be possible without a systematic attempt to solve the vital problem of nitrogen supplies. With a proper organisation every cultivator in the country can be convinced that, with some extra effort and very little cash expenditure, he can grow every year organic manure required for his fields.

The optimum amount of green manure for paddy fields varies from two thousand to eigth thousand pounds per acre. This quantity can be produced in four to six weeks by using twenty to thirty pounds of seeds per acre. If two ounces of seeds of *Dhaincha* or *Sesbania speciosa* are planted on the bunds in an acre field along with the main crop in July, it is possible to produce from sixty to one hundred and sixty pounds of seeds before December in unirrigated areas with 30" and over of rainfall. Seedlings of Dhaincha and *Sesbania speciosa* can also be raised along with paddy seedlings and transplanted in the same field along the margins of the bund. This is usually done after transplanting paddy when the plants are 8" to 12" high.

In places where paddy is sown broadcast as in many parts of Orissa, about fifteen pounds of Dhaincha or *Sesbania speciosa* seeds may be sown along with paddy and, after about a month when the paddy crop is thinned by ploughing, the green manure plants are pulled out and trampled into the field. This method of green manuring has helped to increase the yield of paddy twelve per cent according to experiments carried out in the Central Rice Research Institute at Cuttack.

In many parts of Uttar Pradesh, the wheat fields are kept fallow during the rainy season from July to September, in which case a green manure crop of Sannhemp, *Dhaincha* or *Sesbania speciosa* can be easily raised and ploughed into the field by the middle of August.

7. CONCLUSION

At present some government farms purchase farm yard manure or composts for use on the farms and sometimes even obtain green manure seeds from the market. This has a damaging effect on the development of local manurial resources, for no cultivators will take the advice of agricultural officers seriously as long as the state farms do not practice their teachings. It should therefore be made obligatory on the part of all government farms to produce within two to three years their full requirements of organic manure.

At the same time the enthusiasm of the cultivators has to be created and kept up throughout the country. The village level worker shall play a leading part in this. He has to approach individual cultivators and induce them to grow the green manure plants for producing seeds

and the shrubs for making composts. He should supply them with necessary seeds.

Experience in Madras shows that the increase in the yield of paddy by the use of green manures is cumulative, and there is a steady increase from year to year until an average of about 2,500-3,000 lbs. of paddy per acre is obtained as against the present all India average of about 1,100 lbs. per acre. Further increases can be secured by combined use of organic manure and fertilisers both nitrogenous and phosphatic. Apart from increasing the yields, the incorporation of organic manure helps to increase the capacity of the soil to retain more moisture under rainfed conditions. Experimental work done in Bihar shows that green manuring not only increases the yield of paddy but also lowers its water requirements by ten per cent. Under similar conditions of drought, the green manured paddy crop fares better than in unmanured fields.

In the last season an attempt was made at my insistance to grow green manure seeds locally in the states of Bihar, West Bengal, Assam, Orissa, Uttar Pradesh and Madhya Pradesh in cooperation with the state governments. Nearly two million packets of green manure seeds were distributed in these states, each packet sufficient for sowing on the borders of an acre field. Based on the experience gained, arrangements have been made to distribute 6.5 million packets of seeds in these states in the current year. If the plan can be fully carried out, over 12 million acres will be green manured. By the end of this year, sufficient seeds would be obtained for border plantings in 1959, in the hope that 50 million acres can then be green manured in these states. The campaign for producing green manure seeds should be vigorously extended to most of the other states; but in those states where green manure seeds cannot be produced, an effort should be made to develop soil composts.

SAMPLING AND ANALYSIS OF LOWLAND RICE SOILS IN MALAYA

A.R. McWalter

and

G.W. Arnott[1]

1. INTRODUCTION

The value of soil analysis has often been questioned. Thus Belgrave (2), in discussing the value of the various methods of soil analysis in the light of his experience in Malaya, stated that "Mechanical analyses are of distinct utility", but that "there is .... at the present time (1928) no experience in Malaya which would justify expenditure on routine chemical analysis". It is true, as far as upland soils are concerned, that routine chemical analysis in Malaya is yielding only limited useful information either for soil classification or for advisory work. Under the tropical climatic conditions as prevail in Malaya, rock formations, initially of widely differing compositions, appear to weather to sedentary soils which, by chemical analysis, are remarkably alike.

But in the classification and evaluation of lowland rice soils, since close field examination of the soil is often not possible due to the presence of a high water table, it becomes necessary to devise methods of assessing soil fertility by physical and chemical analyses. Fortunately, lowland rice soils in Malaya consist mainly of fairly recently deposited alluvium and, in such juvenile soils where the processes of profile development are still in progress, it has been found that very valuable information can be obtained from physical and chemical analyses. Furthermore, laboratory analysis of rice soils must be carried out as a check on soil classification even when profile inspection and field classification are possible.

The analytical determinations which have proved to be most easily interpreted in terms of soil fertility, and consequently of most immediate value, are mechanical analysis, pH, loss on ignition, conductivity of aqueous extract, content of soluble chloride and sulphate, cation exchange capacity, content of individual exchangeable cations, and C/N ratio. In every case, however, interpretation of the significance of the results of analysis is possible only when

1. *Acting Senior Soil Chemist and Soil Chemist respectively, Department of Agriculture, Kuala Lumpur, Malaya.*

(a) a suitable sampling technique has been employed; and

(b) results of analyses carried out on a large number of soil samples from representative rice-growing areas are available for purposes of comparison.

In Malaya we have carried out in the past few years extensive sampling and analysis, using standardised techniques, and we are still continuing them. By following the analytical procedures enumerated above, we can now quote with a fair degree of confidence optimum values for a high yielding rice soil. In the case of other analyses such as "easily soluble" phosphorus and potash, we have not yet succeeded in linking up accurately response to P and K fertilization with soil content of "easily soluble" P & K. Since Malayan paddy soils show a very wide variation. However, a start has been made in this direction by soil sampling in many manurial experiment sites and paddy test stations in various parts of the country. Contour maps are being drawn, showing levels of "easily soluble" P & K on the paddy test stations, and an attempt is being made to link up results of chemical analyses carried out on the unfertilised soil at the experimental sites with crop response to fertilization. A start has also been made on filing all data on the properties of Malayan rice soils on a clip-card system, in order to facilitate a correlated study of them.

In what follows an outline is given of the methods of soil sampling and analysis employed in Malaya.

2. SOIL SAMPLING

Methods. While the analytical methods employed in the Soils Laboratory of the Department of Agriculture, Malaya, are all standardised, the techniques adopted in soil sampling must be varied according to the kind of information required and the nature of the terrain to be sampled. Thus different sampling methods are employed:

(a) for large tracts of swamp jungle and water-logged areas,

(b) for developed areas where during the dry season the water-table falls sufficiently to permit close examination of the soil profile,

(c) for small areas such as experimental sites, cultivator's plots' etc.

Sampling of large tracts of undeveloped swamp jungle is carried out by means of auger borings spaced at intervals of about $\frac{1}{4}$ mile along traverse lines cut along a compass bearing through the jungle and spaced about $\frac{1}{2}$ mile apart. Samples are normally taken by means of a 6" diameter auger at depths of 0-9" and 9-18", and where peat is encountered its depth is estimated by means of a Hiller type peat auger. If the peat is less than 5 feet deep a sample is taken of the underlying mineral soil, partly to establish

whether the nutrient status of the peat is likely to be high and partly to find out what nature of soil would remain should it be possible to remove the overlying peat layer by drainage and burning. It is realised that such widely spaced samplings can give only a broad indication of the variation in soil properties, but the data obtained is sufficient to show what proportion of the area under survey is suitable for development. Similarly, grid sampling has been employed in mapping the variation in soil properties within a paddy test station and in comparing soil properties between all the paddy test stations in Malaya. A sampling density of five to six points per acre was employed and the depth of sampling was 0-9" and 9-18". Again it is realised that a higher density of sampling is desirable but shortage of staff prohibited this.

Sampling of the "rice-bowl" areas in Kedah and Kelantan has been in progress for the past three years. The sampling, which is carried out concurrently with the mapping of soil boundaries, is again on a "grid" basis or, when time and staff shortage are limited, at fixed intervals along compass traverses selected to cross established soil boundaries between all the various soil series employed in mapping the area concerned. The soil samples are taken from each horizon of the profiles exposed in pits dug either by hand or by means of 18" diameter power-driven augers mounted on Ferguson tractors. At the same time, as the samples are taken, the soils at the sites are classified into previously established series, and detailed descriptions of the profiles are made on standard tabular forms. In Kedah an area of some 300,000 acres was soil sampled in this manner at intervals of 1,000 yards along lines spaced one mile apart. In Kelantan sampling is in progress along selected lines, the pits being spaced at intervals of 200 yards, and in addition to samples from each horizon, duplicate composite samples of topsoil are taken at each pit site. The reason for the closer spacing of sample pits in Kelantan than in Kedah is that the Kelantan rice soils consist largely of a complex system of river terraces, while the Kedah rice soils consist mainly of marine alluvium laid down in a relatively simple pattern. In Kelantan each soil series occurs in rather small, scattered and sharply defined areas. In Kedah the various series cover large continuous areas, but the boundaries between series are rather poorly defined and can only be mapped with an accuracy of about 100 yards. It is hoped that, by carrying out profile sampling at fixed spacing on the ground, the general profile characteristics of each soil series can be established, and also the amount of variation in profile characteristics, which occurs within each series, can be indicated.

In sampling relatively small areas such as control plots on experimental sites, it has been found in Malaya that duplicate composite samples, each from five points, give a good estimate of the

mean value of such soil properties as pH, easily soluble phosphate etc. On fertilised plots twice this number of sample points is required for each composite sample.

In sampling control plots on experimental sites, composite samples are taken at depths of 0-1", 1-6" and 6-12", or, where a definite plough sole exists, at depths of 0-1", 1" to ploughsoil and ploughsoil to 12". The object of this sampling is to find out how much the upper parts of rice soil profiles are affected by ploughing and intermittent water-logging. To obtain these samples core samplers are used, or in very dry soils shallow pits are dug and samples taken from the pit face.

Equipment. Trowels, "chops" or knives are used to take samples from profile pits. Two inch diameter steel tubes with sharp cutting edges have proved useful for taking samples to a depth of 12" in fairly soft soils. The cores so taken are pushed out with a plunger on to a board marked with lines 1" apart. The core is then sliced with a large knife at natural or arbitrarily chosen horizons.

Types of auger. Although Welch and Fitts (9) have noted that results from samples taken with augers often differ significantly from those taken with other tools, it has been necessary to adopt the use of augers in certain circumstances e.g. swamp jungle surveys. Various types of augers have been tested, but a really good one has not been found. Among those used is the Hiller Peat Auger which is excellent for measuring the depth of peat or muck soils. However, many borings have to be taken with it before a sufficiently large sample for analysis is obtained. Six inch diameter augers have been used, and one and a half inch screw type augers for taking samples for compositing will be tried soon. A new type of completely sheathed screw auger has been designed and it is hoped to prove suitable for more general application.

Sampling bags. Thin plastic bags 9"×12" in size have been used for many years and they are especially useful for wet samples, being safer and easier to carry than either glass jars or metal cans. The plastic bag is protected by a canvas bag which is numbered. The soil samples taken weigh approximately one kilo. For ease of transport through the jungle, large canvas bags (each holding ten or more small bags) have been made and used. It should be mentioned that it is often necessary to carry samples and equipment for many miles in swamp jungles where the rate of progress may be one mile or less per hour. A compromise must often be made between the labour available and the optimum number of samples to be taken.

3. SOIL ANALYSIS

The report of the fourth meeting of the Working Party on Fertilisers of the International Rice Commission (3) suggests a system which, if followed, would result in more uniform treatment of samples from paddy fields in the different countries and would enable them to differentiate between soils of varying productivity....". In the Soil Laboratary of the Department of Agriculture, Malaya, the various analyses carried out on soils are classed as "routine", "special routine" or "research" as indicated below. It will be seen that most of the analyses listed in the recommendation of the I.R.C. are included, but it must be emphasised that only the routine analyses are done in any great numbers.

A. Analytical procedure and methods used in Malaya

Routine analyses are done on almost all soil samples collected and these include:

1. pH on 1:2.5 soil/water suspension using a Pye tropicalised meter with spear type glass electrode.
2. Moisture and loss on ignition.
3. Mechanical Analysis by Bouyoucos Hydrometer Method—dispersion of soil with Tetron.
4. Carbon by the Walkley-Black Method.
5. Nitrogen by Kjeldahl Micro-distillation.
6. Easily soluble phosphorus in a pH 1.8 acid extract (0.1 N hydrochloric acid and 0.03 N ammonium fluoride) by the molybdenum blue method.
7. Easily soluble potassium by extraction with 0.5 N acetic acid and measurement in a Lange Model II Flame Photometer.
8. Conductivity on a 1:10 soil/water suspension measured with a Conductivity Bridge.
9. Chloride by titration of filtrate from above using silver nitrate.
10. Sulphates by gravimetric barium sulphate method.

Special routine analyses are done on some selected samples, due to labour shortage. The following are included:

1. Water holding capacity.
2. Sticky point determination.
3. Lime requirement.
4. Water analysis.
5. Arsenic analysis on water and sediments.
6. Cation exchange capacity.
7. Exchangeable Ca, Mg, K, Na and hydrogen.
8. Total sulphur.

Research analyses which are done for special purposes include:

1. Clay separation and silica and sesquioxide determinations.
2. Different forms of nitrogen.
3. Total phosphorus.
4. Organic phosborus.

5. Phosphate fixation.
6. Total potassium.
7. Potassium absorption.

The present research projects include:

1. Soil phosphorus and its absorption/fixation.
2. Soil potassium and its absorption/fixation.
3. Use of ion-exchange resins in soil analysis.
4. Analysis of soils in both wet and dry states.
5. Methods for iron, aluminium, manganese and minor element determination.

With an increasing emphasis on soil survey, a few of the laboratory staff have been transferred temporarily to the field work. Generally 4,000 samples are received each quarter year, and a staff of ten make 40,000 analyses on them.

B. The organisation and rationalisation of soil analysis

In general, procedures and methods of analysis are developed to obtain a compromise between high accuracy and high speed. The analytical error is usually small when compared to the sampling error but, even then, is required to keep the former at a reasonable level of plus or minus five per cent.

Soil preparation. Samples are dried in the sun, ground and sieved to 2 mm. size. Grinding was formerly done by a simple motor-driven mortar and pestle or by hand, but now a very well designed grinder (developed at the Rokuhia Agricultural Research Station, New Zealand) is being used and should prove much quicker. The 2 mm. sieved soil is then put into waxed cardboard containers from which it is easy to weigh out samples for analysis. Trolleys are used for transport within the laboratory and batch shaking and filtering procedures are used whenever necessary.

Control. It is advisable to have some method of controlling the reproducibility and accuracy of routine soil analysis. Vermeulen (8) describes the excellent system used in Holland. In Malaya the procedure adopted is to introduce one standard soil sample in every twenty determinations.

Methods. A detailed description of the routine methods of analysis has been prepared and copies of this will soon be available to anyone interested. Similar pamphlets are being written on soil survey and sampling sechniques, special routine and research analysis, and plant analysis. Among other publications of interest to soil laboratories is a comprehensive treatise by Metson (5) which contains much valuable information.

Collaborative testing. An O.E.E.C. publication (6) stresses the importance of collaborative testing between laboratories in one country or in one climatic area.

This idea has been suggested (by the authors) to the various agricultural research institutes in Malaya, Sarawak and Borneo and all appear to be interested in the project, which includes the interchange of methods of analysis and of standard samples of soil and plant material.

C. Discussion of some methods and results

Cation exchange. Very interesting results are obtained from the determination of cation exchange capacity and exchangeable Ca, Mg, K, Na and H. The method of Mehlich (4) has been adopted and has proved very suitable for semi-routine use. The more common ammonium acetate method has been tried and is found to give comparable results but, in our experience, it is less adaptable to semi-routine use. However, in some cases it is used for comparative purposes.

Soil samples from the Kedah Survey have been examined. In this survey, traverses were made at right angles to the coast and profile pit samples taken every 1,000 yards. It was found that, as the distance from the coast increases, the percentage saturation decreases gradually from 100 per cent at the coast to 10 to 20 per cent inland. The potassium concentration is the first to decrease and then the sodium follows. Calcium decreases last and more slowly than the monovalent cations but more quickly than the magnesium.

Nitrogen. Analysis of ammoniacal nitrogen has been done on fresh samples taken according to the method of Abichandani and Patnaik (1) and initial results show that it is a promising line of investigation. In good soils the nitrogen level was higher under shallow than under deep water, but on poor soils the nitrogen level was generally low.

4. SUMMARY

The work in progress on survey, sampling and analysis of lowland rice soils in Malaya is outlined. Subjects mentioned include the approach to pedology, survey methods, tools and techniques, analytical methods and the organisation and rationalisation of soil analysis. It is noted that a system of collaborative testing between laboratories is of importance.

References

1. Abichandani, C.T., and Patnaik, S., (1957); "Analysis of Wet Paddy Soil", Joint Meeting of the IRC Working Parties on Rice Breeding, Fertilizers and *ad hoc* Working Group on Soil-Water-Plant Relationships, Vercelli, Italy.
2. Belgrave, W.N.C. (1928); "Soil

Analyses and Their Limitations", Malay. Agric. J., 16, 289-295.

3. FAO Agricultural Development Paper No. 48 (1954), Report of the Fourth Meeting of the International Rice Commission's Working Party on Fertilizers, p. 29.
4. Mehlich, I.W. (1953); "Rapid Determination of Cation and Anion Exchange Capacity of Soils", J. Ass. Off. Agric. Chem., 36, 445.
5. Metson, A.J. (1956); "Methods of Analysis for Soil Survey Samples", Bull. 12, New Zealand Dept. of Scientific and Industrial Research.
6. O.E.E.C. (Organization for European Economic Cooperation, 2, Rue Andre-Pascal, Paris-XVI e) (1956); Project 156, "The Organization and Rationalisation of Soil Analysis". 219 pages.
7. Schuylenborgh, J. van, (1954); "Effect of Air-drying of Soil Samples upon Some Physical Properties". Ned. J. of Agric. Sc., 2, 1, 50-57.
8. Vermeulen, F.H.B. (1953); "Control of the Reproducibility and Accuracy of Routine Analysis at the Laboratory for Soil and Crop Testing in the Netherlands". Plant and Soil, 4, 267-75.
9. Welch, C.D., and Fitts, J.W. (1956); Soil Sc. Soc. Am. Proc., 20, 54-56.

FARMERS' SCHOOLS IN CHINA

C.W. Chang[1]

I. INTRODUCTION

Shortly after the outbreak of the war with Japan in 1937, the government of China was moved from Nanking to Chungking, Szechuan Province. Szechuan is the largest province of China, with an estimated population of 50 million people during the War. The province is rich in both natural and agricultural resources. It produces rice, wheat, corn, cotton, silk, sugar cane, tobacco leaves, oilseeds, vegetables, fruits and many other products. Because of its peculiar climatic conditions, citrus fruits and apples can be grown side by side in certain areas. It is reported that oranges originated in the Chungking region. The Chengtu basin is a rich rice growing area, extending to 14 counties under an effective system of irrigation constructed more than two thousand years ago. It is a marvelous engineering feat even from the standpoint of modern science.

In a place near Chungking, known as Tz Liu Ching or Artesian Wells, natural gas and salt solutions are produced. The local people use the natural gas to heat the salt solution to crystalize salt in sufficient quantities for local consumption as well as for supplying the other inland provinces. This was particularly important when such supply was cut off from the coastal areas during the war.

In 1941, during the height of the war with Japan, the Provincial Government of Szechuan, under instruction from the National Government, began to put the new county government system into operation, which had been found successful in a few model counties in the prewar days. The purpose of the system was to bring about agricultural production increase and rural betterment through the reorganization and strengthening of the county government and the establishment of local self-governing bodies. In order to do this properly, the provincial government had organized a provincial supervision committee on the implementation of the new county government system in September 1941. The committee consisted of five members invited by the government for their knowledge of and experience in the movement, with the governor of the province to serve as chairman. The committee met frequently in the government, going over the reports of the various government agencies concerned with the implementation of the new county govern-

1. *Regional Agricultural Adviser, FAO Regional Office for Asia and the Far East, Bangkok, Thailand.*

ment system and making recommendations for improvement. Sometimes the committee members made field inspection trips and gave advice on the spot.

II. FARMERS' SCHOOLS

One of the adopted recommendations of the supervision committee was the establishment of farmers' schools in the province wherever possible. The schools were of two kinds: farmers' foundation schools and farmers' high schools. They can be briefly described as follows:

Farmers' foundation schools. The foundation schools were designed mainly for farmers who had one or more years of elementary education between the age of 15 and 25. Each school required 100 hours for graduation and the courses of study are listed as follows:

1. Language study	50	hours
2. Practical agriculture	40	,,
3. Civics	10	,,
Total	100	hours

Farmers' high schools. Those farmers who had finished the foundation schools might enter the farmers' high schools for 120 hours. Those farmers who had finished the lower primary schools (Grades I-IV) could also be admitted to the farmers' high school. The courses of study were prescribed as follows:

1. Language study	50	hours
2. Practical agriculture	50	,,
3. Civics	20	,,
Total	120	hours

The text books for language study were prepared within the limit of one thousand characters, which had been found by the mass education movement in China through many years of study and experimentation to be most commonly used by the average Chinese. One reader was prepared for each of the two kinds of schools and each reader had about 40 lessons, all written in simple language and based on local materials. It was expected that a student who had finished the foundation school course could read and write simple letters and keep farm accounts, and that one who had finished the high school course could read popular articles and government announcements.

There were two kinds of agricultural teaching materials prepared for these farmers' schools, namely: job lesson sheets and monographs. These will be fully described later.

For the civics course, simple but interesting stories were prepared about the history and geography of the province and the country, the purpose and operation of the new county government system, and the rights and duties of a citizen.

These farmers' schools, as described above, could be set up in any public places

such as school buildings, temples or community centers. They could be conducted any time of the year according to local conditions. In general they were held during the slack season when the farm work was not pressing.

In Penghsien, which was a model county on the new government system in the province, there were about 10 farmers' foundation schools in operation in 1943, each with an average enrollment of 20 students. Each school was headed by an elementary school teacher or an elder of the community in which the school was located. Other elementary school teachers were enlisted to help teach such courses as language and civics. Farm advisers of the county government served as teachers of practical agriculture. Before the schools started, all teachers selected were given three days of in-service training in the county government. They were each given a small allowance for services rendered. The applicants were required to fill out application forms before admission. It is the characteristics of most Chinese that they like to learn. The enrollment of each school had to be limited for effective teaching. All the text books used were given free by the government, the only condition being that the holders must finish the study. Otherwise such text books must be returned or paid for. There was also a free supply of exercise books and pencils during the course.

In the Chinese new year time of 1944, there was a joint closing exercise for the graduates of all the foundation schools in the county government. At this time the magistrate of the county government presented each of them a certificate, and prizes to those graduates who had made good grades in their studies. Due recognition was also extended to the school teachers for the services willingly rendered. Students and the teachers alike were all proud of their achievements.

The young farmers after graduation automatically became members of a young farmers' association, organized on the bases of individual schools and then federated with other associations in the whole county. They would each receive a kind of news letter published regularly by the provincial government through their federation in the county. This helped to keep them in good spirit and informed of recent development.

These trained young farmers proved to be good collaborators with the county farm advisers in all kinds of agricultural improvement activities. The relationship between them was one between teachers and students. It was intimate and they respected each other.

III. AGRICULTURAL TEACHING MATERIALS

As mentioned earlier, there were two kinds of agricultural teaching materials prepared by the provincial government for distribution to county governments for use in accordance with their local conditions and requirements. These agricultural teaching materials were job lesson sheets and monographs and they will be described below.

Job lesson sheets. One farm job constitutes a lesson, which is published on a sheet. Each lesson describes a job, which may be an improvement over the present practice on the farms or an introduction of something new to the farmers. The job must be simple and practical and will not entail much cost or trouble in adopting it. It must be so described that the average farmer can follow it and put it into practice without difficulty.

During the three years of experimentation before the end of the war in 1945, about 100 different kinds of agricultural jobs were described and published as job lesson sheets by the agricultural publication committee of the provincial supervision committee on the implementation of the new county government system. Each county government could select 10 or more such job lesson sheets according to itsl ocal conditions and need, and use them as teaching materials in the farmers'schools as well as in general extension work.

A good example of such job lesson sheet is found in an article entitled "How to make compost", written by R.A. Isidro, Bureau of Agricultural Extension, the Philippines, and published in Rural Missions, No. 104, Winter 1948, by Agricultural Missions, Inc., 156 Fifth Avenue, New York 10, N.Y., U.S.A. It is reproduced here as follows:

"There is no hard and fast rule with respect to the definition or the method of manufacturing compost. Compost is decomposed material made mostly from farm waste like corn stalks, rice straw, abaca waste and others. This is mixed with animal waste such as horse or carabao manure, chicken droppings and the like. As to methods, the cheapest and quickest method is always the best.

"The application of compost to our soil is one of the best and cheapest means by which we can replace the valuable organic matter that is gradually lost by cropping and soil erosion. Organic matter plays a very important role in our crop production. The application of compost together with commercial fertilizer gives better and more lasting effect both to the productivity and physical our soil than when commercial fertilizer conditionof is applied alone.

"In line with our national program on soil conservation, let us all work together hand in hand with our farmers

in manufacturing and using compost in all our farms.

"How Compost Heap Manure Is Piled

"Location: Select a portion of a field which is well drained, otherwise strong rains may flood and spoil the heap. It is preferable to build the heap near an animal shed or barn where animals are kept, or in a field where the water supply is accessible.

"Materials: The materials for composting are withered leaves, weeds, lawn grass clippings, spoiled rice straw, kitchen vegetable waste, chaff, prunings, garden residues, sawdust and other plant materials one can get in the premises. Farm manure and rich top soil mixed with wood ashes or lime contribute the most important part in the manufacture of compost.

"Preparing the Heap: Remove the grass sod from the spot selected so the bacteria in the soil may have immediate contact with the materials placed on top. This method requires less labour than the pit system.

"Constructing the Heap: The size of the heap depends on the area of the farm or garden to be fertilized. A good size for the average garden is about three meters long and one and half meters high. Start by putting a layer of straw and weeds to about 15 to 20 centimeters thick and follow with a layer about five centimeters of manure. Cover the manure with well pulverized soil slightly mixed with wood ashes or lime if available to a depth of about two centimeters. After each layer, spinkle some water evenly to facilitate decomposition.

"Continue piling alternately fifteen to twenty centimeters of straw or weeds, five to six centimeters of manure covered with soil slightly saturated with wood ashes or lime up to a height of about one and half meters. The last layer of manure should be thicker than the others.

"Construct the heap with sides tapering so that the base will be wider by about fifty centimeters than the top. Make the center saucer-like so as to retain as much water as possible from occasional rains. Mulch the heap on all sides to protect it from drying.

"If the construction of the heap is done during the dry season, it should be watered from time to time.

"Turning the heap: Three weeks after the heap is done it is turned so that the outside will be placed inside. The idea is to have all the materials undergo heating, fermenting, and decaying action inside where bacteria can work more actively. Five weeks after the first turn, it is turned again. Four to eight weeks after the heap is constructed, the compost heap is ready for application. If the finished product is not used right away it

should be covered to protect it from drying or from strong rains.

"The Process of Composting: If the heap does not sink in a few weeks, it is a sign of poor aeration and of the slowing down of bacterial action. Another bad sign is the odor of ammonia emanating from the heap which may mean that it is too tightly packed. A too wet condition is likewise detrimental. In such cases it is better to make the heap again. The same trouble arises when the heap is dry. Consequently the heap should have the right moisture and temperature so that the fermenting organism may work properly.

"Spreading the Compost: The finished product may be applied to the field by forking out of a bull-cart as it moves very slowly over the field. Spreading is done during a cloudy day so that some of its ammonium constituents will not be so easily lost. It should be plowed under within three hours if it is to retain its full value."

Monographs. Monographs were prepared on the leading crops of the province, with a view to improving them as enterprises. They included such crops as rice, wheat, corn, cotton, tobacco leaves, sugar cane, sweet potatoes, vegetables and oranges. Each crop is treated in all its problems of production, conservation and marketing so that a grower may be able to see his way clear about all the problems he is likely to face in growing a particular crop of major importance.

Take a monograph on rice as an illustration of how it was prepared. The monograph may be divided into the following Chapters:

Chapter 1. Rice Cultivation
Chapter 2. Land Preparation
Chapter 3. Manure and Fertilizers
Chapter 4. Seed Selection and Treatment
Chapter 5. Nursery Beds
Chapter 6. Transplanting
Chapter 7. Irrigation
Chapter 8. Weeding
Chapter 9. Insect and Disease Control
Chapter 10. Harvesting
Chapter 11. Storage and Processing
Chapter 12. Marketing.

Each chapter has three sections as follows:

Section 1. This is a list of questions, aiming at arousing the interest of the learners in the subject and relating the study to the actual situations obtaining in their home communities. For instance, for the chapter on Rice Cultivation, the following questions can be asked:

1. Do you grow rice on your farm?
2. Why do you grow rice in preference to other crops?
3. How widely is rice grown in your neighbourhood?
4. Why is it that some farms produce more rice than others?
5. Have you ever tried to increase your rice yield?

Questions like these stimulate their thinking and in the meantime a favourable learning situation is being set up.

Section 2. In this section there are a few paragraphs of reading material based on the rice growing conditions in the province. From this reading material the learners will find answers to some of the questions raised above. The reading material must be short and concise. One must know the rice situation in the province very well before writing it.

Section 3. In this section a few exercises are suggested for field observations or practices. For instance, reference is often made to acre yield or hectare yield. Do the learners really understand the exact size of an acre or a hectare? In a field practice the teacher can take the class out and measure the size of one or two fields and then figure it out on the basis of an acre or a hectare. Another related question is the weight. Are they really familiar with the weight system, a pound or a kilogram? A practice can be planned for it too.

The other chapters of the monograph on rice can be similarly prepared. In a community usually one or two major crops are grown. If a farmer can study the related monographs thoroughly, he certainly knows what sort of problems he is likely to encounter in growing these crops, and will be prepared to meet them.

IV. PREPARATIONS OF THESE TEACHING MATERIALS

The provincial supervision committee on the implementation of the new county government system entrusted the preparation of agricultural teaching materials to the college of agriculture and forestry of the university of Nanking, which was one of the refugee universities in Chengtu during the war. The college in turn organized a publication committee, composed of the director of the provincial bureau of agricultural improvement and the deans of several agricultural colleges that were then located in the province. Under this committee there were several subcommittees organized such as subcommittees on food crops, on industrial crops, on livestock, and on horticultural crops. It was for these subcommittees to propose suitable topics and to develop them into teaching materials, as the members of these subcommittees were specialists in their own fields. Usually one or two members were asked to prepare a draft on a topic, which would have to be reviewed and approved by the subcommittee concerned. Then the draft would be edited by adult education specialists to make sure that it was simple and readable and written within the one thousand characters that the farmers were taught in the farmers' schools. After this, a limited number of copies of the teaching

material would be made available for testing its suitability in a few selected farmers' schools. If proved satisfactory, it would be printed either in the form of a job lesson sheet or a monograph, as the case might be, in sufficient quantities for distribution.

The criteria for approval of an article set up by the publication committee were as follows:

1. The article must teach a farm job better than the present practice or introduce a new practice to improve farming efficiency.
2. The teaching must be simple and within the means of the averge farmer to adopt it.
3. The teaching must be based on appproved practices.
4. The article must be readable and suitable to be used as a teaching material in the farmers' schools.

As mentioned earlier, during the three years of experimentation before the end of the war, about 100 kinds of job lesson sheets and 10 different kinds of monographs were prepared and published for use in the province. These teaching materials were the results of research, and proved to be useful to the farmers. They were written in the simplest form possible so that the farmers could follow them without difficulty.

For each article prepared and accepted, a reasonable amount of remuneration was paid, and the name of the author was printed on the article as a means of recognition and encouragement.

V. CONCLUDING REMARKS

During the early stage of extension development in Asia and the Far East, there are many problems. Some of them may be administrative or organiztional problems, while others may be financial difficulties. Granting that these problems are reasonably solved, there is still a basic problem to ask: "Do we really have a message for the farmers?" In other words, do we have something really worthwhile to teach them? One eminent American professor of extension once remarked: "In the early days of extension in the U.S.A., we, extension workers, had no training in extension methods and very little facilities at our disposal, but we have accomplished something. Now there are countries, with many people trained in extension principles and methods of teaching and a reasonable amount of equipment, but very little has been accomplished. I wish to know why."

Of course there are many reasons one can give for the unfruitfulness of the situation. But in the final analysis, it may be largely due to the theoretical training of the extension workers and the

unavailability of suitable teaching materials for them to use in extension work. There may be a wealth of useful information accumulated in agricultural experiment stations in a country, but it is not available in a form or forms that extension people can make use of. The research workers are used to write scientific papers, which are beyond the comprehension of the average people. The field level extension workers, who need the information most, may not have time or enough resources to prepare it. So there is often a wide gap between scientific knowledge and field applications. This is the place where the subject matter specialists can be very useful. They should help to translate the scientific knowledge into simple terms and make it available for the use of extension workers.

REPORTS OF THE COMMISSION AND ITS WORKING GROUPS

Reports of the Commission

Report of the First Session, Bangkok, Thailand, March 1949
Report of the Second Session, Rangoon, Burma, February 1950
Report of the Third Session, Bandung, Indonesia, May 1952
Report of the Fourth Session, Tokyo, Japan, October 1954
Report of the Fifth Session, Calcutta, India, November 1956

Reports of the Working Party on Rice Breeding

Report of the First Meeting, Rangoon, Burma, February 1950
Report of the Second Meeting, Bogor, Indonesia, April 1951
Report of the Third Meeting, Bandung, Indonesia, May 1952
Report of the Fourth Meeting, Bangkok, Thailand, September 1953
Report of the Fifth Meeting, Tokyo, Japan, October 1954
Report of the Sixth Meeting, Penang, Malaya, December 1955

Reports of the Working Party on Fertilizers

Report of the First Meeting, Bogor, Indonesia, April 1951
Report of the Second Meeting, Bandung, Indonesia, May 1952
Report of the Third Meeting, Bangkok, Thailand, September 1953
Report of the Fourth Meeting, Tokyo, Japan. October 1954
Report of the Fifth Meeting, Penang, Malaya, December 1955

Report of the ad hoc Working Group on the Problems of Mechanization of Rice Production under Wet Paddy Conditions

Report of the First Meeting, Peradeniya, Ceylon, May 1956

Report of the ad hoc Working Group on the Problems of Storage and Processing of Rice

Report of the First Meeting, Calcutta, India, November 1956

Report of the ad hoc Working Group on the Problems of Soil, Water and Plant Relationships in the Production of Rice

A Preliminary Report by Correspondence, November 1956

Joint Report of the Seventh Meeting of the Working Party on Rice Breeding; the Sixth Meeting of the Working Party on Fertilizers; and the First Meeting of the ad hoc Working Group on Soil-Water-Plant Relationships

Held at Vercelli, Italy, September 1957.

PRINTED AT PRACHANDRA PRINTING PRESS, MAHARAJA ROAD,
BANGKOK, THAILAND.
MR. SANAN BUNYASIRIBHANDHU.
PROPRIETOR, PRINTER AND PUBLISHER.
1958